Mortality Disparities Across Russia: Evidence From a Small Area Analysis

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Background: During the last decade, life expectancy in Russia has finally begun increasing after four decades of negative trends and fluctuations. In spite of this progress, it still remains much lower compared to developed countries and some developing countries, and much more must be done to close the gap. Within this general context, health disparities within the country, including spatial disparities, are a major concern. While the better-off population groups are on the path to reducing mortality, large population groups are still exposed to very high mortality.

Previously, spatial differentials in mortality could only be accessed at a level of large regions ("oblasts"). This resulted in aggregate patterns, with much heterogeneity being hidden. To the best of our knowledge, this is the first exploration into mortality disparities across 2,369 small areas, or districts ("rayons").

Data: The mortality data (age- and sex-specific number of deaths) have been obtained for the districts from the vital registration anonymous micro-data on all deaths that occurred in Russia between January 1, 2008 and December 31, 2012. The population denominator was obtained from the 2010 all-population census conducted by the Federal State Statistics Service (Rosstat). The raw population data were initially presented in a complicated way that required much effort to accurately distribute all the deaths by the districts according to the municipal division scheme used in the census.

We excluded 130 districts from analysis. Twenty-one of them had very low population sizes (<1,000 males and/or females), or had no data on deaths; in some cases, it was impossible to match deaths and population-at-risk securely. The other 109 Muslim districts of the North Caucasus were excluded due to uncertainty about the quality of statistical data on population or vital events, especially concerning old ages. The total size of the population excluded constituted only 4.9% of the total population.

For international comparisons, we used data on male and female life expectancy for a number of countries from the Human Mortality Database and the 2015 Revision of the UN World Population Prospects.

Methods: The age-standardized death rates (SDRs) were computed for men and women from deaths over the 5-year period around the 2010 census as a numerator and the census population multiplied by five. The spatial mortality distribution was estimated with statistical quantities, including several measures of absolute and relative inequality. Then we ordered all the districts by their SDR values and divided districts into eight groups based on population percentiles, with two 5% groups of the lowest mortality, two 5% groups of the highest mortality and four 20% groups in between. The group-specific life expectancy values were compared with corresponding values in a number of countries with different mortality levels. The public health impact of the spatial disparities was assessed with the population attributable fraction.

Results: The basic spatial inequality measures, both unweighted and weighted, appear in Table 1. The distribution of districts, weighted by their population size, is shifted towards lower values of SDRs, as densely populated districts are more likely to experience lower mortality than sparsely populated areas in Russia. SDRs in the "worst" districts are almost 6 times higher than in the better-off population groups, both for males and females. The differences in interquartile range-a more robust measure of dispersion-are less pronounced, but still exist, particularly for men.

Table 1. Selected statistics on mortality variation across districts (N=2,239), by sex

	Males	Females
Mortality distribution:		
Max (95% CI)	47.74 (40.00; 55.49)	29.73 (26.10; 33.37)
Min (95% CI)	8.57 (8.44; 8.70)	5.17 (3.64; 6.69)
Min-Max Range	39.17	24.57
Min to Max Ratio	0.18	0.17
Mean	20.43	9.76
Variance	12.25	3.40
StD	3.50	1.84
Population weighted mortality distribution:		
Q75	19.94	9.34
Median	17.66	8.37
Q25	15.87	7.64
IQR	4.08	1.70
Mean, weighted	17.74	8.55
Variance, weighted	12.76	2.07
StD, weighted	3.57	1.44
Coef Var, %	20.14	16.83
SII (Slope Index)	12.80	5.97

The division of all the districts into eight groups according to their SDR values and the share of the population is presented in Figure 1. The "best" group, Group I, comprises the population of several districts of metropolitan cities Moscow and St. Petersburg, some "scientific" and "closed" cities with highly educated populations, and rich oil-and-gas areas in West Siberia with an average life expectancy at birth equal to 71.5 and 79.5 years for males and females, respectively (Table 2). In contrast, the life expectancy of Group VIII, which mainly includes sparsely populated rural districts of the Far East and East Siberia, is 15.4 and 10.3 years lower for men and women, respectively.

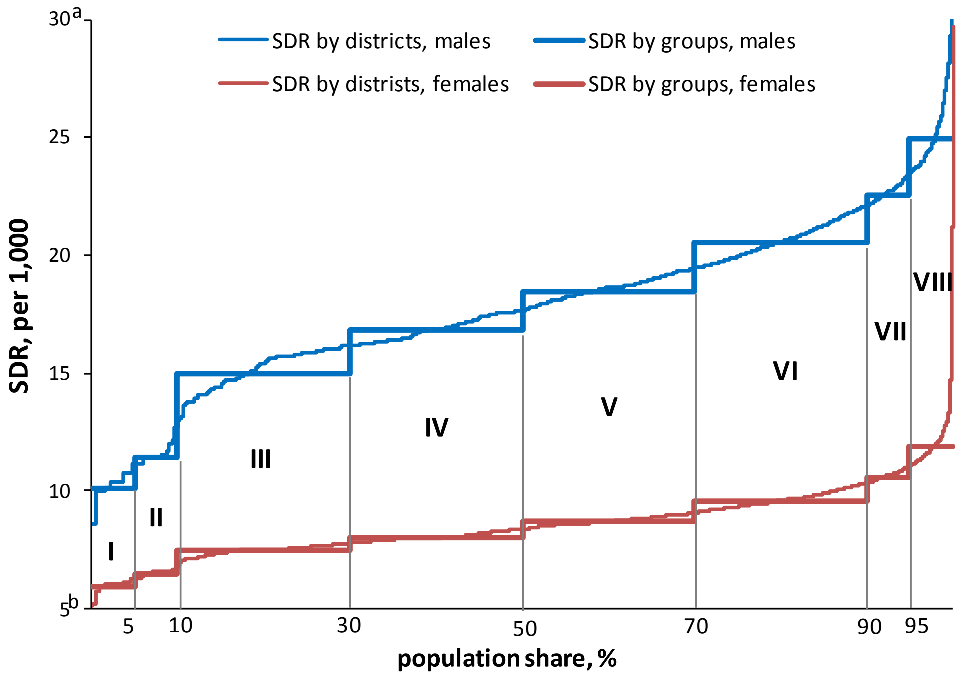

Figure 1. Age-standardized death rates (SDR) in separate districts and eight groups of districts, by sex.

Note: [a] for better visibility, y-axis is limited by SDR=30 per 1000; 0.13 % population has higher mortality level

Table 2. Characteristics of the eight groups of districts within Russia.

	Males				Females			
	Pop. size, mln	Number of districts in a group	SDR, per 1,000	LE at birth, years	Pop. size, mln	Number of districts in a group	SDR, per 1,000	LE at birth, years
*Group I**	*2.98*	*12*	*10.08*	*71.53*	*3.35*	*11*	*5.91*	*79.50*
Group II	3.10	17	11.42	69.57	3.88	18	6.50	78.37
Group III	12.55	180	15.00	65.95	14.70	155	7.45	76.89
Group IV	12.62	215	16.82	64.11	14.76	204	8.04	75.87
Group V	12.66	445	18.49	62.32	14.52	437	8.72	74.66
Group VI	12.55	744	20.51	60.12	14.64	786	9.59	73.14
Group VII	3.14	271	22.52	58.25	3.65	252	10.60	71.43
Group VIII	3.14	355	24.97	56.06	3.67	376	11.93	69.16
Total	**62.74**	**2239**	**17.54**	**62.95**	**73.17**	**2239**	**8.50**	**74.91**

Note: *reference group for PAF calculations.

We quantified the demographic cost of spatial inequalities in mortality by calculating the mortality population attributable fraction (PAF):

$$PAF = \frac{\sum_{i=1}^{8} P_i \cdot MRR_i - \sum_{i=1}^{8} P_{group\ I} \cdot MRR_i}{\sum_{i=1}^{8} P_i \cdot MRR_i}$$

where $MRR_i = \frac{SDR_i}{SDR_{group\ I}}$ is the mortality rates ratio from SDRs using Group I as a reference group, P_i is the share of population in each group, P_{groupI} is share of population in the reference group (Group I). PAF estimates the size of excess mortality assuming that the mortality level would be reduced to the level currently seen in Group I. The PAF for male mortality is 62.36% of all deaths; for female mortality it is 63.01%.

Finally, we compared the life expectancy of Groups I to VIII with the life expectancy statistics of developed countries and some developing countries. Figure 4 shows that life expectancy, even among the better-off population groups in Russia, is still much lower than most life expectancy statistics in the West and in East European countries. For example, only 5% of the male population in Russia lives as long as an average man in Poland.

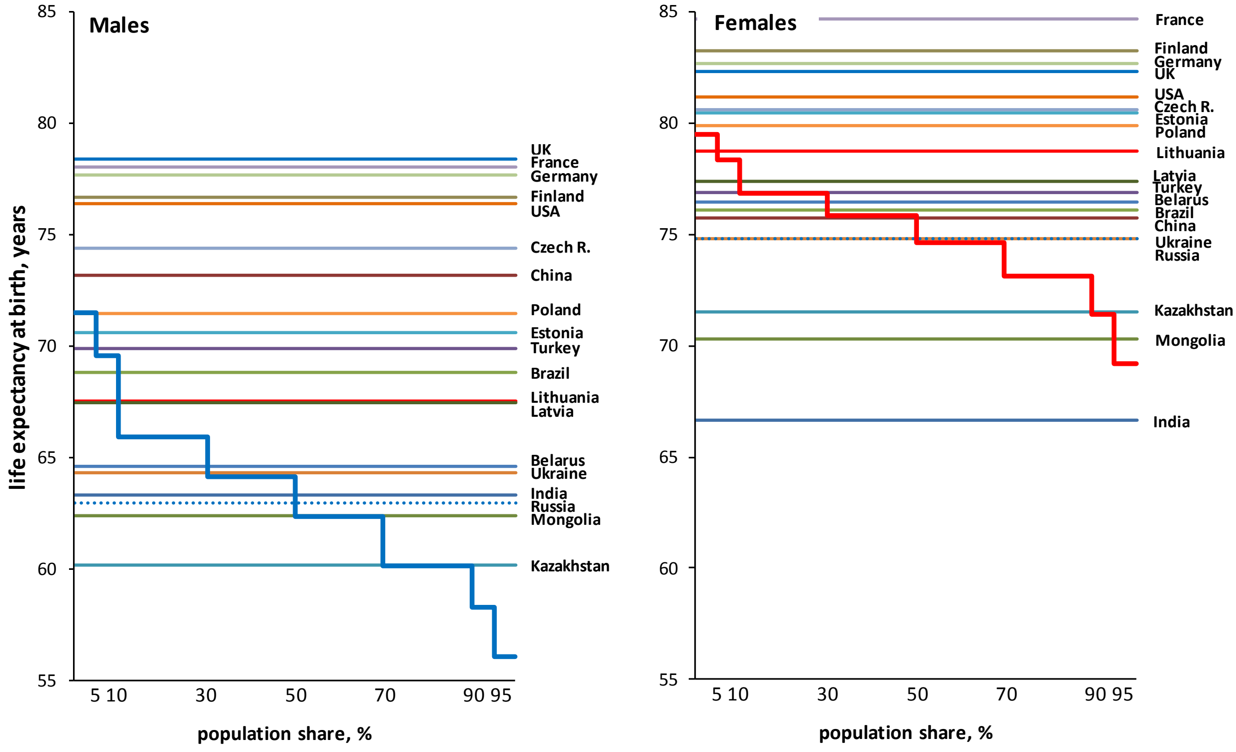

Figure 4. Comparison of life expectancy in eight groups of Russian districts with a number of countries, by sex, around 2010.

Source: Authors' calculations, HMD, UN World Population Prospects: The 2012 Revision.